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In the High-Technology Realm

SPECIAL SECTION: SECURITY DIRECTORY



Frank Suraci, technical director for the National Communications System's (NCS') Government Emergency Telecommunications Service (GETS), tests videoconferencing equipment for priority communications. The test was part of a 12-day interoperability exercise involving four countries.

Ensuring Emergency Calls on the Next-Generation Network

International tests demonstrate priority telecommunications and global interoperability.

The federal government is exploring new technologies to ensure vital communications links among government officials in times of crisis. At the heart of these efforts is the worldwide transition to Internet protocol telephony and its broad capabilities. Given the global nature of these communications changes, the government is turning to the international test arena to evaluate new priority telecommunications approaches.

Two U.S. emergency communications services already have served key roles in disaster response and recovery. These

By Stephen C. Barrett

systems, which prioritize emergency telephone calls, have served federal, state and local leaders; emergency response personnel; key critical infrastructure heads; and other people with national security and emergency preparedness responsibilities.

The Government Emergency Telecommunications Service (GETS) played a critical role in handling calls during and after the September 11, 2001, terrorist attacks. Users of GETS, along with the more recently developed Wireless Priority Service (WPS), also communicated information and coordination among leaders and emergency personnel



Members of the NCS test team discuss testing procedures during a global interoperability testing session at Verizon Communications facilities in Waltham, Massachusetts. Members include (l-r) Chandra Kathirvelu and Tom Phelan of Sonus Networks, Dr. Arye Ephrath of the NCS team, Naseem Khan of Verizon Communications and Chao-Chi Ho of the NCS team.

in 2005 when the devastating hurricanes Katrina, Rita and Wilma battered the Gulf Coast states. During these disasters, GETS successfully routed 95 percent of all emergency calls, which enhanced the ability of emergency personnel to make critical decisions, coordinate support and begin the recovery process.

The National Communications System (NCS) created GETS and the WPS in response to a White House tasking to provide federal, state and local officials, as well as other authorized personnel associated with national security and emergency preparedness (NS/EP) missions, with the means of obtaining priority in placing telephone calls via the public switched telephone network (PSTN) during times of emergency or when the telephone network is otherwise congested.

NCS NS/EP communications services provide emergency access and priority processing in the local and long distance segments of the public switched wireline and wireless networks. The NCS uses these NS/EP priority schemes in emergency or crisis situations during which the probability of completing a call over normal or other telecommunication means has significantly decreased due to congestion or network damage. The NCS contracts with commercial wireline and wireless telephony carriers and with network equipment vendors to provide GETS and WPS priority capabilities in these networks.

But the NCS—part of the U.S. Department of Homeland Security's Preparedness Directorate—also is taking advantage of new technology to design, test and prepare for future challenges in emergency communications programs. With public, circuit-switched telephony networks migrating

to Internet protocol (IP)-based packet infrastructure, the NCS has embarked on an effort to enable these priority capabilities to the packet-network environment of the evolving next-generation networks, or NGN. "These efforts not only address voice telephony but also take advantage of the high bandwidths offered by the NGN to define additional session-based priority telecommunications services such as video teleconferencing over IP networks," says Frank Suraci, technical director for GETS and the WPS and a member of the NCS Technology and Programs Division.

Part of answering those challenges took place in late October 2006 when NCS engineers participated in a 12-day communications test event based in four international locations. During the 12-day event, which was sponsored by the international MultiService Forum (MSF), NCS personnel conducted a series of tests demonstrating the extension of NS/EP capabilities from the traditional public

switched network to the newer IP system in the NGN.

Known as Global MSF Interoperability 2006 (GMI 2006), the event spanned three continents, involved five international communications carriers and 26 communication equipment manufacturers, and employed more than 200 network devices. Exercise hubs were hosted in North America by Verizon and by the University of New Hampshire's Interoperability Laboratory in Durham, New Hampshire. In Japan the hubs were hosted by Nippon Telegraph and Telephone facilities, in Korea by Korean Telecom, and in the United Kingdom by British Telecom/Vodafone. NCS personnel, comprising government staff and contract support, participated in the event from Verizon Laboratories in Waltham, Massachusetts.

Suraci relates that the primary NCS objectives at GMI 2006 were to demonstrate NS/EP features of end-to-end priority voice and priority video sessions in an NGN environment. "In recent years, the NCS has been prototyping and analyzing alternative network configurations designed to achieve these objectives," he states. "These prototypes, based on existing and emerging international standards and on commercially available networking equipment, have been used to assess various methods of user authentication and several priority mechanisms in IP-based networks." He adds that the NCS considers GMI 2006 an important step and a proof of concept for developing priority services in an NGN environment for NS/EP users.

To guarantee NS/EP priority telecommunications in the NGN, each network component requires special features to ensure a high probability of establishing and maintaining the session. "The originator's authority for a priority

telecommunications session must be authenticated,” Suraci notes. Once authenticated, each session must have special priority features, and the call will be transported with priority through the network.

In the current circuit-switched telephone network, an authorized caller initiates a GETS priority call by dialing an NCS-specific access number. Local exchanges in the United States recognize this access number and route the call to one of three interexchange carriers—AT&T, Sprint or Verizon Business—that are under contract to provide this priority service.

The service then prompts the caller to enter a personal identification number (PIN), similar to a calling-card number. If the PIN is valid, the system routes the call with priority features to its destination. These features include granting the caller priority in accessing available circuits, routing the call around damaged or congested network segments, queuing the call when no circuits are immediately available and exempting the call from certain network management control restrictions.

The signaling associated with the call carries a marker that identifies the call as an NS/EP call, and the network treats the signaling messages with priority over normal telephone calls. In the case of WPS, the cellular caller indicates a priority WPS call by dialing an NCS-specific prefix. The caller does not need to enter a PIN, however, as the network recognizes the caller’s mobile handset as pre-authorized to initiate priority calls.

According to Suraci, priority communications in the packet-switched NGN will share some features with the circuit-switched GETS and the WPS. “The system will still recognize the GETS access number and will cause the caller to authenticate via a PIN entry,” he explains. “However, the capabilities inherent in the digital network elements of a packet-switched network also make possible additional, more convenient authentication schemes.”

In the NGN, the network will carry signaling messages via what is known as the session-initiation protocol (SIP). “The signaling messages may include a priority marker, called the resource priority header, or RPH,” he says. “This identifies the call and indicates to the network the priority of the session being established.”

Suraci adds that when the RPH indicates an NS/EP communications session, the system provides priority at two levels. At the session or signaling level, the system may admit an NS/EP session by the network’s border gateways into a congested NGN—even when the system blocks nonpriority sessions to protect the network from being overloaded. At the transport or packet level, the system marks the individual data packets carrying priority communications as such and, consequently, supports priority processing at the network’s routers.

To ensure that GETS and WPS capabilities are not used illegally, the NCS restricts origination of priority sessions to NCS-authorized users. In the circuit-switched PSTN, the system authenticates the user’s identity via the entry of a 12-digit PIN. In the IP-based NGN scenario, the NCS tested this authentication method also, because newer systems supporting GETS and the WPS must support this

scheme for backward compatibility and the broadest set of terminal devices and telephone sets.

However, the GMI 2006 testing also demonstrated two additional authentication methods referred to as the profile-based method and the challenge-response method. The profile-based method uses the session originator’s profile, which is stored in the subscriber’s home network, to verify the originator’s identity and privileges.

In contrast, in the challenge-response method the network automatically challenges the originator’s intelligent terminal or smart telephone to provide authentication data when attempting to place a priority call. The intelligent terminal then creates the appropriate response message, processed by an application server to authenticate and authorize the user. Suraci relates that the NCS successfully tested all three methods.

In IP communications, service providers must manage network usage carefully to ensure sufficient resources to handle all the active sessions. Known as admission control, this process refers to new session setups that may deny requests, especially as the network’s available bandwidth or other resources near exhaustion. “Service providers define a threshold—often as some fraction of the full theoretical capacity—and will not admit calls that will result in aggregate demand exceeding that threshold,” Suraci notes.

However, during GMI 2006, the NCS demonstrated that authenticated requests for NS/EP priority sessions can grant admission up to and beyond the capacity limits defined for nonpriority calls. When the test network was placed in a congested condition, the admission control mechanisms ensured priority access to the network for NS/EP calls.

A system may provide priority treatment to data packets in several ways. These include special markings for each packet, which provides the packets with priority handling at the network’s routers. Or, it may reserve a portion of each link’s bandwidth for priority traffic as well as establish separate, reserved priority routes through the network. “The system must provide this priority transport treatment,” Suraci says. “It must be provided not only to the payload packets that carry the voice, video or data associated with the service, but also—and more importantly—to the packets that carry the signaling messages used to control each priority session.”

Suraci notes that the ongoing migration to the NGN infrastructure is providing the NCS technical staff with an opportunity to develop and implement additional session-based priority telecommunications services such as priority videoconferencing. As with GETS and the WPS, establishing a priority videoconferencing session will require the proper authentication of the originator’s identity and privileges. The NCS tested methods of priority video communications at GMI 2006 using controls similar to those in the GETS service. The priority treatments of a multimedia session similarly include preferential admission and priority packet markings. Suraci notes that to make priority video possible, the NCS must establish the type of privileges and the preferential admission and that packet markings must all function across both the audio and video channels of a videoconference session.

Another area tested was interoperability. During the transition from circuit-switched public telephony to the IP-

based NGN, the two technologies must co-exist and interoperate because the transition is likely to last for a number of years. In this hybrid environment, Suraci adds, it is imperative that NS/EP priority services function seamlessly on calls between circuit-switched and IP domains.

"Interoperability implies that priority sessions spanning more than one network type maintain their priority status across the networks' boundaries," he declares. "Signaling and transport gateways between the networks must perform appropriate protocol mappings, including the priority indicators."

Suraci adds that the NCS demonstrated these capabilities during GMI 2006. NCS engineers collaborated with several commercial network equipment vendors to demonstrate that network elements can support NS/EP priority features that comply with international standards and with MSF implementation agreements. In addition, the NCS demonstrated the interoperability of priority features between an IP-based network and a circuit-switched legacy network, as well as an origination identification restriction feature for caller anonymity.

These GMI 2006 demonstrations showed that priority treatment of NS/EP sessions in the NGN is technically feasible, Suraci states. The NCS demonstrated that priority capabilities can be extended from voice communications to multimedia sessions. And, sophisticated techniques can be used in the NGN to authenticate NS/EP users and that voice priority features can interoperate between the circuit-switched PSTN and the NGN.

"It is because GMI 2006 brought together the networking equipment of multiple commercial vendors, and its test network spanned the globe, that useful operational data could be gathered," Suraci reflects. "Adherence to well-established international standards can result in cost-effective interoperability among a broad spectrum of carriers, vendors and technologies."

These sentiments are echoed by Naseem Khan of Verizon, a member of the MSF board of directors. "As the service providers have begun to embrace NGN technology in their network transformation efforts, it is critical that the industry agree upon a GETS/WPS solution for the NGN," Khan declares. "The GMI 2006 conclusions clearly demonstrate that the industry is making progress in this important area."

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WEB RESOURCES

National Communications System: www.ncs.gov

Government Emergency Telecommunications Service:
<http://gets.ncs.gov>

Wireless Priority Service: <http://wps.ncs.gov>

MultiService Forum: www.msforum.org

GMI 2006: www.msforum.org/interoperability/GMI.shtml

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